

Customer No.: 31561
Application No.: 10/064,503
Docket No.: 9170-US-230

REMARKS

Present Status of the Application

The Office Action mailed September 11, 2003 rejected all presently pending claims 1-11. Specifically, claims 6 and 7 were objected to under 37 CFR 1.75(c) for broadening the scope of claim 1 from which they are dependent. Claims 1-5 and 8-11 were rejected under 35 U.S.C. 102(b) as being anticipated by EP 1092465 A2 (EP '465). Claims 6 and 7 were further rejected under 35 U.S.C. 103(a) as being unpatentable over EP '465 in view of Golden et al. (US 5,919,286). In response thereto, Applicants have amended claims 1, 4, 6 and 9 and canceled claims 2, 3, 5 and 7. Reconsideration of claims 1, 4, 6 and 8-11 is respectfully requested.

Summary of the Application

This invention is directed to an apparatus for purifying air used as a raw material in cryogenic air separation and a corresponding method. The apparatus comprises an adsorption cylinder that comprises a first adsorbing layer and a second adsorbing layer, wherein the first adsorbing layer comprises a first adsorbent capable of selectively adsorbing water in the air, and the second adsorbing layer comprises a second adsorbent capable of selectively adsorbing nitrogen oxides and/or hydrocarbons in the air passing the first adsorbing layer. The second adsorbent comprises 1) an X zeolite that contains magnesium ion as an ion-exchangeable cation and has a magnesium-exchange ratio higher than 40%, 2) an X zeolite that contains magnesium and calcium ions as ion-exchangeable cations and has a magnesium-exchange ratio higher than

Customer No.: 31561
Application No.: 10/064,503
Docket No.: 9170-US-230

5%, or 3) an A zeolite that contains calcium and magnesium ions as ion-exchangeable cations and has a magnesium-exchange ratio higher than 5%.

Discussion of Objections and Rejections of Claims 6 and 7

Claims 6 and 7 were objected to under 37 CFR 1.75(c) for broadening the scope of claim 1 and further rejected under 35 U.S.C. 103(a) as being unpatentable over EP '465 in view of Golden et al. Applicants have *amended claim 6 as an independent claim to overcome the objections* and incorporated claim 7 into claim 6 to overcome the rejections. Claim 7 is canceled accordingly.

One feature of amended claim 6 is that the A zeolite serving as the second adsorbent contains calcium and magnesium ions as ion-exchangeable cations and has a magnesium-exchange ratio higher than 5%. The feature is recited in claim 6, marked by underlines:

6. An apparatus for purifying air used as a raw material , comprising:
an adsorber comprising an adsorption cylinder , wherein
the second adsorbent comprises an A zeolite containing calcium and magnesium ions as ion-exchangeable cations, wherein a magnesium-exchange ratio in total cations of the A zeolite is higher than 5%.

EP '465 does not mention any A zeolite, while Golden et al. fails to teach or suggest to use an A zeolite that contains calcium and magnesium ions as ion-exchangeable cations and has a magnesium-exchange ratio higher than 5%. Golden et al. merely discloses the use of A zeolite for removing nitrogen oxides, but does not mention the species of the exchangeable cations in the A zeolite and any ion-exchange ratio of the A zeolite at all. Therefore, *at least the above feature of claim 6 cannot be obtained by combining EP '465 and Golden.*

Customer No.: 31561
Application No.: 10/064,503
Docket No.: 9170-US-230

Moreover, the co-existence of calcium and magnesium ions in A zeolite and the specific range of the magnesium-exchange ratio of A zeolite both are not obvious in view of Golden et al., since *the existence of magnesium ion effectively increases the adsorption amount of nitrogen oxides and a critical change in the adsorption amount is observed when the magnesium-exchange ratio is higher than 5%, as shown in FIG. 5.*

For at least the reasons mentioned above, Applicants respectfully submit that amended claim 6 patently defines over the prior art.

Discussion of Rejections of Claims 1, 4 and 8-11

Claims 1-5 and 8-11 were rejected under 35 U.S.C. 102(b) as being anticipated by EP '465. Please note that Applicants have canceled claims 2, 3 and 5 and amended claims 1, 4 and 9.

Rejections of Claims 1 and 8-11

One feature of amended claims 1 and 9 is that the X zeolite serving as the second adsorbent has a magnesium-exchange ratio higher than 40%. The feature is recited in amended claims 1 and 9, marked by underlines:

1. An apparatus for purifying air, comprising:
an adsorber comprising an adsorption cylinder that comprises a first adsorbing layer and a second adsorbing layer,, wherein
the second adsorbent comprises an X zeolite containing magnesium ion as an ion-exchangeable cation, wherein a magnesium-exchange ratio in total cations of the X zeolite is higher than 40%.

9. A method for purifying air, comprising:
providing a purifying apparatus, wherein the second adsorbent comprises an X zeolite containing magnesium ion as an ion-exchangeable cation, and a magnesium-exchange ratio in total cations of the X zeolite is higher than 40%; and
using the first adsorbing layer

Customer No.: 31561
Application No.: 10/064,503
Docket No.: 9170-US-230

EP '465 fails to teach or suggest to use an X zeolite that has a *magnesium-exchange ratio* higher than 40%. EP '465 merely discloses using an X zeolite that is 0-100% Ca exchanged and 100-0% exchanged with other ions including Group IIA ions other than calcium, while *a range of exchange ratio of any specific ion (e.g., Mg ion) among the "other ions" is never disclosed.*

Moreover, the magnesium-exchange ratio higher than 40% is also not obvious in view of EP '465, since 1) the *Ca exchange ratio* rather than the Mg exchange ratio is the most important parameter in EP '465 according to the contents of paragraph [0020], 2) the disclosed range of the exchange ratio of the other Group IIA ions is overly broad (100-0%) in EP '465 and 3) specifically incorporating Mg ion into zeolite X is not suggested and taught in EP '465. *More importantly, a critical change in the adsorption amount of nitrogen oxides is observed when the magnesium-exchange ratio is higher than 40%, as shown in FIG. 3.*

For at least the reasons mentioned above, Applicants respectfully submit that amended independent claims 1 and 9 patently define over the prior art.

For at least the same reasons mentioned above, Applicants respectfully submit that claims 8 and 10-11 dependent from claims 1 and 9, respectively, also patently define over the prior art.

Rejections of Claim 4

One feature of amended claim 4 is that the X zeolite serving as the second adsorbent, which contains calcium and magnesium ions as ion-exchangeable cations, has a magnesium-exchange ratio higher than 5%. The feature is recited in amended claim 4, marked by underlines:

4. An apparatus for purifying air , comprising:
an adsorber comprising an adsorption cylinder , wherein

Customer No.: 31561
Application No.: 10/064,503
Docket No.: 9170-US-230

the second adsorbent comprises an X zeolite containing magnesium and calcium ions as ion-exchangeable cations, wherein a magnesium-exchange ratio in total cations of the X zeolite is higher than 5%.

EP '465 fails to teach or suggest to use an MgCaX zeolite (= an X zeolite containing magnesium and calcium ions as ion-exchangeable cations) that has a *magnesium-exchange ratio* higher than 5%. EP '465 merely discloses using an X zeolite that is 0-100% Ca exchanged and 100-0% exchanged with other ions including Group IIA ions other than calcium, while *a range of exchange ratio of any specific ion (e.g., Mg ion) among the "other ions" is never disclosed.*

Moreover, the magnesium-exchange ratio of MgCaX zeolite higher than 5% is also not obvious in view of EP '465, since 1) the *Ca exchange ratio* rather than the Mg exchange ratio is the most important parameter in EP '465 according to the contents of paragraph [0020], 2) the disclosed range of the exchange ratio of the other Group IIA ions is overly broad (100-0%) in EP '465 and 3) specifically incorporating Mg ion into zeolite X is not suggested and taught in EP '465. *More importantly, a critical change in the adsorption amount of nitrogen oxides is observed when the magnesium-exchange ratio of MgCaX zeolite is higher than 5%, as shown in FIG. 4.*

For at least the reasons mentioned above, Applicants respectfully submit that amended claim 4 patently defines over the prior art.

CONCLUSION

For at least the forgoing reasons, it is believed that pending claims 1, 4, 6 and 8-11 are in proper condition for allowance. If the Examiner believes that a telephone conference would

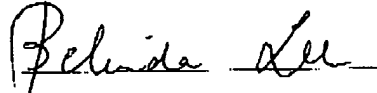
Customer No.: 31561
Application No.: 10/064,503
Docket No.: 9170-US-230

expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Respectfully submitted

Date :

Dec. 2, 2003


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